Revised 2/03/2006

Asphalt Plant Mix Design
Technician Proficiency Test

Student Name (print) _____ I.D. No. _____

Student I.D. Number _____

Company Name
(or VDOT- Dist./ Div.) _____

Company Address _____

_____

Employer's Phone No. _____

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*Asphalt Plant Level I Proficiency Required? _____ If "no", date tested: _____

***NOTE: Proficiency test not required if previously passed within one year.**

PART I		Test		Retest	
		P	**F**	**P**	**F**
AASHTO T30	Mechanical Analysis of Extracted Aggregates				
AASHTO T166	Bulk Specific Gravity				
AASHTO T209	Maximum Specific Gravity (RICE)				
AASHTO T269	Percent Air Voids in Compacted Specimens				
VTM 102	Ignition Method				
AASHTO T312	Gyratory Compaction				
AASHTO T283	Tensile Strength Ratio				
VTM-120	Method of Test for Measurement of Permeability of Bituminous Paving Mixtures Using a Flexible Wall Permeameter				

Comments _____

_____

_____

_____

Student's signature _____ Date: _____

Proctor's signature _____ Date: _____

Revised 2/03/2006

Aggregate Properties
Technician Proficiency Test

PART II

		Test		Retest	
		P	**F**	**P**	**F**
ASTM D4791	Flat & Elongated				
ASTM D5821	Percentage of Fractured Particles - Coarse Agg.				
AASHTO T176	Sand Equivalent				
AASHTO T19	Unit Weight				
AASHTO T304	Percent Air Voids in Compacted Specimens				
AASHTO T84	Specific Gravity& Absorption of Fine Aggregate				
AASHTO T85	Specific Gravity& Absorption of Coarse Aggregate				

Comments _____

Student's signature _____ Date: _____

Proctor's signature _____ Date: _____

Mechanical Analysis of Extracted Aggregate
AASHTO T30 (1998)

(This section may be omitted if Plant I proficiency testing is NOT required.)

1. Equipment

   a. Nest of Sieves: upper sieve No. 10 or 16 (2.00 or 1.18mm) sieve. _____
   lower sieve a No. 200 (0.075mm) sieve. _____

   b. Oven or hot plate capable of maintaining 230 ± 9°F (110 ± 5°C). _____

   c. Balance capable of weighing to 0.1% of sample mass (0.1 g). _____

2. Procedure

   a. Sample consisting of all aggregate after extraction. _____

   b. Minimum mass of mix sample based on nominal maximum size. _____

   c. Sample placed in container and covered with water. _____

   d. Wetting agent added. _____

   e. Contents agitated vigorously. _____

   f. Wash water poured through nest of sieves. _____

      1. Washing continued until wash water is clear. _____

   g. Material placed in pan. _____

   h. Material dried to constant mass at 230 ± 9°F (110 ± 5°C) . _____

   i. Material weighed to nearest 0.1 percent (0.1 gram). _____

   j. Material sieved on specified sieve sizes. _____

      1. Sieving continued until not more than 0.5 percent by mass of total sample passes a given sieve in 1 minute. _____

   k. Each fraction of aggregate weighed. _____

   n. Does summation of aggregate mass check against total washed dry mass within 0.2 percent? _____

3. All calculations performed correctly. _____

Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens
AASHTO T166 - 00 Method A

(This section may be omitted if Plant I proficiency testing is NOT required.)

1. Equipment

a. Balance and Suspension:

1. Conforms to M231 for class required (sensitive to 0.1 g). _____
2. Suspension from center of balance pan. _____
3. Suspension wire of smallest practical size. _____
4. Holder and sample completely immersed. _____
5. No trapped air bubbles exist under specimen. _____

b. Water Bath:

1. Equipped with overflow outlet. _____
2. Deep enough to completely immerse holder and sample. _____

c. Room Temperature Definition:

1. Room temperature 77 $\pm$ 9°F (25 $\pm$ 5°C). _____

2. Procedure

a. Molded specimens cooled to room temperature. _____

b. Mass of dry sample in air (A) determined in grams. _____

c. Sample immersed in water bath. _____

1. Immersed for 4$\pm$ 1 minutes. _____
2. Water at 77$\pm$ 1.8 °F (25 ± 1°C). _____
3. Specimen weight in water (C) determined. _____

d. Sample removed and blotted with damp towel. _____

e. Saturated surface-dry mass determined (B). _____

f. Percent water absorbed determined to be less than 2 percent. _____
% Water absorbed = (B-A)/(B-C) x 100 _____

g. Bulk specific gravity calculated: A/(B-C). _____

h. Bulk specific gravity reported to nearest 0.001. _____

Maximum Specific Gravity of Bituminous Mixtures
AASHTO T209

(This section may be omitted if Plant I proficiency testing is NOT required.)

1. Flask or bowl calibrated.

   a. Flask or Bowl weighed suspended in water after 10 ± 1 minutes (B). _____

2. Sample obtained by splitting or quartering. [Indicate method used] _____

3. Mass of sample as follows (samples larger than the capacity of the container may be divided into suitable increments, tested and the results averaged). [Indicate the particle & sample size used.] _____

Largest Particle Size	Minimum Sample Size (g)
2 in (50 mm)	6000
1½ in (37.5 mm)	4000
1 in (25 mm)	2500
3/4 in (19 mm)	2000
1/2 in (12.5 mm)	1500
3/8 in (9.5 mm)	1000
No. 4 (4.75 mm)	500

4. Particles of sample separated. _____
5. Care used not to fracture mineral fragments. _____
6. After separating, fine aggregate particles not larger than ¼ in (6.3 mm). _____
7. Sample at room temperature. _____
8. Flask or Bowl weighed in air (C). _____
9. Sample placed in flask or bowl and weighed in air (A). _____
10. Water at approximately 77°F (25°C) added to cover sample. _____
11. Vacuum increased until manometer reads 27.75 ± 2.25 mm Hg. _____
12. Entrapped air removed using partial pressure for 15 ± 2 minutes. _____
13. Container and contents agitated vigorously by mechanical device or manual shaking at intervals of 2 minutes. _____
14. Release of entrapped air facilitated by addition of wetting agent. (optional) _____
15. Release of vacuum by increasing pressure at a rate not exceeding 8 kPa per second (60 mmHg per second). _____
16. Bowl and contents immersed in water for 10 ± 1 minutes _____
17. Weight recorded (D). _____
18. Maximum specific gravity calculated and reported to nearest 0.001. _____
    Max. specific gravity = (C-A) / (C-A)(D-B) _____

Percent Air Voids in Compacted Specimens
AASHTO T269

(This section may be omitted if Plant I proficiency testing is NOT required.)

1. Bulk specific gravity determined according to AASHTO T166 _____

2. Maximum specific gravity determined according to AASHTO T209 _____

3. Percent air voids calculated in accordance with the following: _____

Percent air voids = 100 x〔1-(bulk sp gr/ max sp gr) 〕

Resistance of Compacted Bituminous Mixture to Moisture Induced Damage AASHTO T283 (TSR)

1. Equipment
   - a. Marshall hammer conforming to AASHTO T245 _____
   - OR b. Gyratory compactor from Approved List. _____
2. Vacuum Apparatus
   - a. Vacuum container, preferably Type D from ASTM D 2041 _____
   - b. Vacuum pump or water aspirator including manometer or vacuum gauge. _____
3. Balance conforming to AASHTO T166 (sensitive to 0.1 g) _____
4. Water Baths
   - a. Conforming to AASHTO T166 (proper depth w/overflow outlet) _____
   - b. Capable of maintaining a temperature of 140±1.8°F _____
   - c. Capable of maintaining temperature of 77 ± 1°F _____
5. Freezer capable of maintaining 0±5°F. _____
6. Forced Air Oven capable of maintaining 350±5°F _____
7. Testing Apparatus
   - a. Loading jack and ring dynamometer (AASHTO T245). _____
   - OR b. Mechanical or hydraulic test machine (AASHTO T167). _____
8. Miscellaneous
   - a. Plastic bags. _____
   - b. 10 mL graduated cylinder. _____
   - c. Aluminum pans 1 inch deep with bottom surface area 75-100 square inches. _____
9. Sample Preparation
   - a. Sample prepared in accordance with spec for lab or field specimens. (Lab mixed sample requires proper curing and conditioning.) _____
   - b. Specimens compacted in 2.5 x 4 inch (Marshall) or 3.75 x 6 inch (Gyratory) molds at 7.0 ±0.5 % air voids. _____
     1. Base mix scalped prior to compaction with Marshall hammer. _____
   - c. At least six cores compacted. _____

Resistance of Compacted Bituminous Mixture to Moisture Induced Damage AASHTO T283 (continued)

d. Specimen extruded and allowed to cool to room temperature (24 hours). _____

e. Maximum specific gravity determined in accordance with AASHTO T209 _____

f. Specimen thickness determined by ASTM D3549 _____

g. Bulk specific gravity determined in accordance with AASHTO T166 Method A for each specimen. _____

h. Air voids calculated in accordance with AASHTO T269 _____

i. Specimens sorted into two equal subsets so that average air voids of each subset is approximately equal. _____

10. Preconditioning of Subsets

Dry Subset

a. Dry subset stored at room temperature until tested. _____

b. Dry subset placed in plastic leak proof bag. _____

c. Dry subset placed in water bath at 77°F for two hours prior to testing. _____

Conditioned Subset

a. Specimen(s) placed in vacuum container supported above bottom by minimum 25mm (1") perforated spacer. _____

b. Container filled with room temperature potable water. _____
Specimens have at least one inch of water above their surface. _____

c. Partial vacuum (97.5-502.5mm Hg) applied for short time (5-10 minutes). _____

d. Vacuum removed and specimens allowed to stay submerged for short time (5-10 minutes). _____

e. Bulk specific gravity determined in accordance with AASHTO T166. Saturated surface-dry mass of conditioned samples compared with original saturated surface-dry mass and volume of absorbed water calculated. _____

f. Degree of saturation determined (must have 70-80 percent) _____

g. Specimens covered tightly with plastic film and placed in plastic bag containing 10mL of water and placed in freezer(0±5°F) for minimum 16 hours. _____

h. Specimens placed in 140±2°F water bath for 24 hours. _____
Plastic bag and film should be removed as soon as possible.

Resistance of Compacted Bituminous Mixture to Moisture Induced Damage AASHTO T283 (continued)

i. After 24 hours, specimens removed and placed in 25°C (77°F) water bath for 2 hours. _____

11. Testing

a. Specimens removed from 25°C (77°F) water bath and thickness measured. _____

b. Specimens placed between the steel loading strips. _____

c. Specimens and loading strips placed between bearing pads in the testing machine. _____

d. Load applied at a rate of 2 inches per minute. _____

e. Indirect tensile strength determined for each specimen. _____

f. TSR value calculated _____

12. Calculations performed correctly. _____

a. Optional – recommend use of a data sheet or worksheet. _____

Ignition Method
Virginia Test Method 102 (VTM-102)

1. Ignition Oven Calibration Factor Procedure

a. Ignition oven preheated to 538°C (1000°F). _____

b. Calibration factor of 0.00 entered. _____

c. Four calibration specimens prepared at optimum asphalt. _____

1. RAP AC accounted for in total AC. _____

d. Sample mass conforms to requirements based on nominal max. size. _____

e. Butter batch used before mixing. _____

f. "Blank" aggregate specimen weighed and tested according to AASHTO T30 (Mechanical Analysis of Extracted Aggregate) _____

g. Samples mixed and placed in basket. _____

1. Samples preheated to 257°F if allowed to cool. _____

h. Weight of sample basket and catch pan recorded. _____

i. Sample evenly distributed in baskets. _____

1. Materials kept away from edge of basket. _____

2. Material leveled. _____

j. Weight of sample basket, catch pan, and material recorded. _____

k. Initial sample weight recorded. _____

l. Sample weight entered into ignition oven. _____

1. Verify correct weight is entered. _____

m. Sample placed in oven. _____

1. Appropriate safety equipment used (optional). _____

n. Total sample weight (with baskets) within ±5 grams. _____

1. If not, basket checked to insure no contact is being made with inner walls. _____

o. Start/stop button pushed to begin testing. _____

p. Start/stop button pushed when audible stable indicator sounds.

Ignition Method
VTM-102 (continued)

q. Sample removed from ignition oven and allowed to cool to room temperature _____

r. Gradation performed on residual aggregate. _____

s. Repeat for other specimens. _____

t. Calculate correction (calibration) factor. _____

STOP HERE IF Plant I proficiency testing is NOT required.)

2. Sample Preparation for Routine Testing

a. If necessary, mixture warmed in pan (257 ± 9°F) to constant weight. _____

b. Sample obtained by splitting or quartering. (Indicate method used) _____

c. Size of Sample (not more than 800g greater than minimum weight). _____

Nominal Maximum Aggregate Size		Minimum Sample Mass in grams	
1½	37.5 mm	4000*	_____
1 in	25.0 mm	3000*	_____
3/4 in	19.0 mm	2000	_____
1/2 in	12.5 mm	1500	_____
3/8 in	9.5 mm	1200	_____
No 4	4.75 mm	1200	_____

* Sample may be split and results combined using weighted average

d. Sample baskets tared and weight recorded. _____

e. Sample divided into equal portions for top and bottom basket. _____

f. Baskets set in drip pan when loading and care taken not to lose fines. _____

g. Sample spread with heated spatula into thin even lift. _____

3. Determination of Asphalt Content by Ignition Method

a. Furnace preheated to 538°C (1000°F). _____

b. Correction (calibration) factor for specific mix design entered. _____

c. Sample weight with baskets determined and recorded to nearest gram. _____

d. Initial sample weight entered and verified in furnace controller. _____

e. Sample loaded into furnace and total weight (including baskets) verified prior to initiation of test. _____

Ignition Method
VTM-102 (continued)

f. Proper safety equipment worn when loading sample (optional). _____

g. Sample removed promptly when audible stable indicator indicates constant weigh achieved. _____

h. Proper safety equipment worn when removing sample (optional). _____

i. Sample allowed to cool to room temperature in safety enclosure. _____

4. Gradation Determination

a. Entire contents of sample baskets and drip pan emptied into flat pan, sample baskets cleaned into flat pan with a wire brush. _____

b. Sample weight determined to nearest 0.1 percent (1 gram for sample sizes greater than 1000 grams) for gradation _____

c. Gradation analysis performed in accordance with AASHTO T30. _____

Standard Method for Preparing & Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor AASHTO T 312

1. Gyratory Compactor

   a. One from approved list. _____

2. Molds (at room temperature)

   a. Inside diameter 149.90 to 150.00 mm. _____

   b. At least 250 mm high. _____

   c. Walls at least 7.5 mm thick. _____

3. Ram and base plate faces

   a. Ground flat. _____

   b. Diameter of 149.50 to 149.75 mm. _____

4. Balance capable of weighing pills; readable to 1 gram. _____

5. Forced draft oven thermostatically controlled to $\pm$ 3°C. _____

6. Thermometers armored, glass or dial-type with metal stems. _____

7. Verification of calibration (following items checked periodically)

   a. Ram pressure _____

   b. Angle of gyration _____

   c. Gyration speed _____

   d. LVDT or other continuous height recorder _____

   e. Mold dimensions _____

   f. Plate faces _____

   g. Oven temperature _____

8. Preparation of Apparatus

   a. Main power switch turned on for required warm up period. _____

   b. Angle, pressure and gyration level set. _____

   c. Bearing surfaces lubricated per manufacturer's instruction _____

Standard Method for Preparing & Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor AASHTO T 312 (continued)

9. Preparation of Mixture - Lab Prepared Specimens

a. Aggregate fractions weighed into separate pan and combined to desired batch weight. _____

b. Aggregate and binder placed in oven and heated to mixing temperature. _____

c. Mixing and compaction temperatures used from specification. [sect 211.03(d)6 of *Specifications*] _____

d. Mixing bowl charged with aggregate and dry mixed. _____

e. Crater formed in aggregate and binder added. _____

f. Aggregate and binder mixed quickly and thoroughly. _____

g. First mixing used as butter batch and discarded. _____

h. Mix placed in pan and spread to even thickness from 1 to 2 inches. _____

i. Mix placed in oven set at compaction temperature and aged in accordance with AASHTO R 30 (2 hours at compaction temp) _____

j. Mixture stirred every 60±5 minutes. _____

k. Mix removed from oven and compacted at end of aging period. _____

10. Preparation of Mixture - Plant Prepared Specimens

a. Loose mix brought to compaction temperature by uniform heating. _____

11. Compaction of Specimens

a. Mold, base plate, and upper plate (when required) removed from oven and paper disk placed on bottom of mold. _____

b. Mixture placed in mold in one lift, leveled, and paper disk and upper plate (when required) added. _____

c. Mold loaded into compactor and compaction started. (height recorded to nearest 0.1 mm) _____

d. Compactor shuts off when completed. _____

e. Mold removed and specimen extruded. _____

f. Paper disks removed. _____

g. Specimens conform to height requirement of 115 ± 5 mm. _____

Method of Test for Measurement of Permeability of Bituminous Paving Mixtures Using A Flexible Wall Permeameter
VTM-120

EQUIPMENT:

1. Vacuum container, pump, water bath, and balance as given in T 209 (RICE test). _____
2. Thermometer capable of measuring water temperature to nearest 0.1ºC (0.2º F). _____
3. Manometer as specified in T 209 (RICE test) _____
4. Graduated cylinder: - inner diameter of 31.75 ±0.5 mm (1.25 ±0.02 in.). _____
   - graduated in mm. _____
   - capacity of approx. 500 ml (17 oz.). _____
   -Lower timing mark positioned 20 ± 1 cm (8 ± 0.5 in.) from top of specimen. _____
5. Graduated cylinder, 100 ml capacity (min.), with 1 ml or smaller graduations. _____
6. Sealing tube - a flexible latex membrane capable of confining the specimen. _____
7. Cap Assembly w/ expanding o-ring. _____
   - supports the graduated cylinder. _____
   - underside tapered at angle of 10 ± 1º. _____
8. Pedestal Plate w/ expanding o-ring _____
   - Opening with minimum diameter of 18mm (0.71 in.). _____
   - Top side of lower cap tapered at angle of 10 ± 1º. _____
9. O-rings capable of maintaining seal. _____
10. Frame and clamp assembly capable of expanding the o-rings. _____
11. Air pump capable of applying 103 kPa (15 psi) pressure and also vacuum. _____
    a. Pressure gauge with range of 0 – 103 kPa (0 – 15 psi) with ± 2% accuracy. _____
    b. Quick connects for vacuum and pressure lines. _____
12. Outlet Pipe – 50.8 mm (2.0 in.) long; inner diameter of 18 mm (0.71 in.). _____
    a. Flow line of outlet pipe is level with bottom of specimen _____
13. Valve positioned upstream of outlet pipe. _____
14. Spacer – perforated. Capable of supporting the specimen at least 25 mm (1 in.) above the vacuum container bottom. _____
15. Stopwatch capable of measuring to at least the nearest 0.1 s. _____
16. Meter stick capable of measuring to nearest 1 mm (0.5 in.). _____
17. Caliper capable of measuring to nearest 0.1 mm (0.01 in.). _____
18. Sealing agent (petroleum jelly) and spatula. _____
19. Saw for wet cutting specimens to desired thickness (optional). _____
20. Supply of non-aerated tap water at room temperature. _____

Method of Test for Measurement of Permeability of Bituminous Paving Mixtures Using A Flexible Wall Permeameter
VTM-120 (con't)

TEST PROCEDURE:

1. Laboratory prepared samples:
   - Compacted to specified height in gyratory compactor and allowed to cool. _____

Nominal Maximum Aggregate Size, mm (in.)	Specimen Height, mm (in.)
9.5 (3/8")	38.1 ± 2 (1.5 ± 0.1 in.)
12.5 (1/2")	38.1 ± 2 (1.5 ± 0.1 in.)
19.0 (3/4")	50.8 ± 2 (2.0 ± 0.1 in.)
25.0 (1.0")	63.5 ± 2 (2.5 ± 0.1 in.)

   - Diameter measured in 2 perpendicular directions to nearest 0.5 mm (0.02 in.).___
   - Thickness measured at 4 equidistant locations to nearest 0.5 mm (0.02 in.). _____
   - Bulk Specific Gravity determined. _____
   - Regression Method – 3 sets of 3 (9 total) specimens made over the range of air voids specified. _____
   - Single-Point – 5 specimens compacted averaging 7.5% voids; range of voids ≤ 1.0%. _____
2. Roadway Cores:
   - Individual layers separated and tack removed. Wet sawing is permitted. _____
   - Wash the specimen to remove loose, fine material. _____
   - Diameter measured in 2 perpendicular directions to nearest 0.5 mm (0.02 in.).
     - Diameter is 148.0 – 154.0 mm (5.827 – 6.063 in.). _____
   - Thickness measured at 4 equidistant locations to nearest 0.5 mm (0.02 in.).
     - Measurements do not vary by more than 5 mm (0.2 in.). _____
   - Bulk Specific Gravity determined. _____
3. Saturation of Test Specimens:
   - Specimen supported above bottom of container by a spacer. ___
   - Room temperature water is used; _____
     At least 25 mm (1.0 in.) of water above the specimen. _____
   - Saturate by applying vacuum pressure of 90 ± 2 mmHg.
     Maintain for 15 ± 2 minutes. _____
   - Allow to sit undisturbed at least 5 minutes. Keep submerged until ready to test.___

Method of Test for Measurement of Permeability of Bituminous Paving Mixtures Using A Flexible Wall Permeameter
VTM-120 (con't)

4. Test Procedure:
   - ♦ Check location of lower and upper timing marks. _____
   - ♦ Assemble the apparatus – install the membrane, fill outlet pipe with water, apply petroleum jelly to sides of lab prepared specimen, tighten clamps. _____
   - ♦ Apply confining pressure of 14 ±1 psi (96.5 ±7.0 kPa). _____
   - ♦ Fill with water - close outlet valve, avoid adding air bubbles, tilt to remove trapped air bubbles, fill above the upper timing mark. _____
   - ♦ Run the test until 3 consecutive time measurements are within 10% of the average of those 3 trials. OR stop after 10 minutes and repeat the test. _____
   - ♦ Measure temperature of the permeate water to nearest 0.5ºC (1.0ºF). _____
5. Calculations:
   - ♦ Demonstrate use of the software or calculate by hand. _____

FLAT PARTICLES, ELONGATED PARTICLES, OR FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE ASTM D4791-95

This section may be omitted if Aggregate Properties proficiency testing is NOT required.

APPARATUS

1. Proportional caliper device, similar to Figures 1, or 2 of the test method? .....____

   Ratios of 2:1, 3:1 and 5:1 can be measured? (These are required for VDOT asphalt aggregate testing.) …
2. Verification of ratio, ratio settings on proportional caliper device verified by use of machined block, micrometer, or other appropriate device? .....____

3. Balance, accurate to 0.5% of sample mass? (Sensitive to 1 gram or less.) .....____

4. Oven, maintains 110 ± 5°C (230 ± 9°F) [if determination by mass is required]? .....____
   (Note: VDOT determines F&E by mass rather than particle count.)

PROCEDURE

Sample Preparation

1. Sample mixed and reduced in accordance with C702 to approximately the amount required for testing?.....____
2. Test sample mass when dry conforms to following table: .....____

Nominal Maximum Size, mm (in)	Minimum Mass, Kg (lb)
9.5 (3/8)	1 (2)
12.5 (1/2)	2 (4)
19.0 (3/4)	5 (11)
25.0 (1)	10 (22)
37.5 (1 ½)	15 (33)
50 (2)	20 (44)
63 (2 ½)	35 (77)
75 (3)	60 (130)
90 (3 ½)	100 (220)
100 (4)	150 (330)
112 (4 ½)	200 (440)
125 (5)	300 (660)
150 (6)	500 (1100)

3. Reduction to an exact predetermined mass not permitted?.....____

FLAT PARTICLES, ELONGATED PARTICLES, OR FLAT AND ELONGATED PARTICLES IN COARSE AGGREGATE ASTM D4791-95 (continued)

PROCEDURE (CONT.)

Procedure

1. If determination by mass, sample oven-dried to constant mass at 110±5° C (230±9° F)?.....____
   Note: If determination is by particle count, drying is not necessary.
2. Sample sieved according to C136? .....____
3. Using material retained on 9.5 mm (3/8 in.) or 4.75 mm (No. 4), as required, each size fraction present in amount of 10% or more of original sample reduced according to C702 until approximately 100 particles obtained for each size fraction required?.....____

Flat and Elongated Particle Test:

1. Each particle in each size fraction tested and placed into one of two groups: (1) flat and elongated or (2) not flat and elongated? .....____
2. Proportional caliper device positioned at proper ratio? .....____
3. Larger opening set equal to particle length? .....____
4. Particle is flat and elongated if the thickness can be placed in the smaller opening?.....____
5. Proportion of sample in each group determined by count or by mass, as required? .....____

Calculation

1. Percentage of flat and elongated particles calculated to nearest 1% for each sieve size greater than 9.5 mm (3/8 in.) or 4.75 mm (No. 4), as required?.....____

DETERMINING THE PERCENTAGE OF FRACTURED PARTICLES IN COARSE AGGREGATE ASTM D5821-01

This section may be omitted if Aggregate Properties proficiency testing is NOT required.

APPARATUS

1. Balance, accurate and readable to within 0.1% of sample mass? (Sensitive to 0.1 gram).....____
2. Sieves, conforming to ASTM E11?.....____
3. Sample splitter? .....____
4. Spatula, or similar tool, for sorting aggregate particles? .....____

PROCEDURE

Sample Preparation

1. Sample dried sufficiently to obtain clean separation of fine and coarse material in sieving operation?.....____
2. Sample sieved over 4.75-mm (No. 4) sieve, or other specified sieve for retaining material for this test, in accordance with ASTM C136? .....____
3. Portion retained on sieve reduced to appropriate size for test using splitter in accordance with ASTM C702? .....____
4. Mass of test sample meets either of the following, whichever is smaller?: .....____
   (a) At least large enough so that largest particle is not more than 1% of sample mass? .....____

   or (b) At least as large as indicated below?: .....____

Nominal Maximum Size, mm (in)	Minimum Mass, g (approx. lb)
9.5 (3/8)	200 (0.5)
12.5 (1/2)	500 (1)
19.0 (3/4)	1500 (3)
25.0 (1)	3000 (6.5)
37.5 (1 ½)	7500 (16.5)
50.0 (2)	15,000 (33)
63.0 (2 ½)	30,000 (66)
75.0 (3)	60,000 (132)
90.0 (3 ½)	90,000 (198)

SAMPLE PREPARATION (CONT.)

5. (Optional procedure) For aggregate with nominal maximum size of 19.0 mm (3/4 in.) or larger, where the fracture particle content is to be determined for material retained on the 4.75-mm (No. 4) or smaller sieve:
   (a) Sample separated on the 9.5-mm (3/8-in.) sieve? .....____
   (b) Portion passing 9.5-mm sieve further reduced, in accordance with ASTM C702, to a minimum of 200 g (0.5 lb)? .....____

   Note: This will reduce the number of particles to be separated during the procedure.

   (c) Percent fractured particles determined on each portion?.....____
   (d) Weighted average percentage of fractured particles calculated based on mass of each of the portions to reflect total percentage of fractured particles in the entire sample? .....____

DETERMINING THE PERCENTAGE OF FRACTURED PARTICLES IN COARSE AGGREGATE ASTM D5821-01 (continued)

Procedure

1. Sample washed over sieve designated for determination of fractured particles and dried to constant mass?.....____
2. Mass of test sample, and any subsequent masses, determined to nearest 0.1% of original dry sample mass? (Record sample mass to nearest 0.1 g) .....____
3. Dried sample spread on clean flat surface large enough to permit careful inspection of each particle? .....____
4. Particle held so that face is viewed directly?.....____
5. If the face constitutes at least 1/4 of the maximum cross-sectional area of the particle (and the face has sharp, well-defined edges excluding small nicks), face considered a fractured face?.....____
6. Using spatula or similar tool, particles separated into two categories: (1) fractured particles based on whether the particle has the required number of fractured faces, (F), and (2) particles not meeting the specified criteria, (N)? .....____
7. If required number of fractured faces is not given in applicable specifications, determination made on basis of a minimum of one fractured face? .....____
8. Mass or count of particles in each of the two categories determined? .....____
9. Mass (of particles) used to calculate percent fractured particles, unless percentage by particle count is specified? .....____
10. If more than one number of fractured faces is specified (for example, 70% with one or more fractured faces and 40% with two or more fractured faces), procedure repeated on the same sample for each requirement?.....____

Calculation

1. Mass percentage or count percentage of particles with specified number(s) of fractured faces reported to nearest 1% in accordance with the following equation?: .....____

$$P = [F / (F + N)] \times 100$$

PLASTIC FINES IN GRADED AGGREGATES AND SOILS BY USE OF THE SAND EQUIVALENT TEST AASHTO T176

This section may be omitted if Aggregate Properties proficiency testing is NOT required.

APPARATUS

1. Graduated plastic cylinders:

Outside diameter: 38.1 mm (1.5 in)?								
Inside diameter: 31.0 – 32.0 mm (1.25 in)?								
Inside height: 430 mm (17 in)?								
Graduations at: 2.54 mm (0.1 in)?								
Rubber stopper?								

2. Irrigator tube:
   (a) Outside diameter 6.4 mm (1/4 in.)?.....____
   (b) Length approximately 510 mm (20 in.)?.....____
   (c) Pinched end? .....____
   (d) No. 60 holes (1.0 mm diameter) drilled in two places on end? .....____
   (e) AASHTO only: Handle for irrigation tube (optional)?.....____

3. Satisfactory siphon assembly?.....____

4. Weighted foot assembly:
   (a) Weighs 1000±5 g?.....____
   (b) Guide fixed to shaft? .....____
   Note: Older (1969) model of weighted foot assembly with guide cap that fits over upper end of graduated cylinder is acceptable.

5. Tin measure:
   (a) Diameter approximately 57 mm (2 1/4 in.)? .....____
   (b) Capacity of 85±5 mL (3 oz.)?.....____

6. Wide-mouth funnel?:.....____
   (a) AASHTO only: Diameter approximately 100 mm (4 in.) at the mouth?.....____

7. Clock or watch, readable in minutes and seconds?.....____

8. Shaker (One of the following):
   Note (AASHTO only): Mechanical shaker required for referee testing. Note if mechanical shaker is not presented - informational note only.
   (a) Mechanical? .....____
      (1) Operates at 175 ± 2 cycles per minute? .....____
      (2) Securely fastened to firm and level mount? .....____
   (b) Manually operated?.....____
      (1) Securely fastened to firm and level mount? .....____
   (c) Hand method?.....____

PLASTIC FINES IN GRADED AGGREGATES AND SOILS BY USE OF THE SAND EQUIVALENT TEST AASHTO T176 (continued)

APPARATUS (CONT.)

9. Stock calcium chloride solution (One of the following):
   (a) 454 g (1 lb) technical grade anhydrous calcium chloride, 2050 g (1640 mL) USP glycerin, and 47 g (45 mL) formaldehyde (40% by volume solution); diluted to 4L (1 gallon) with distilled or demineralized water? ____
   or (b) 577 g (1.27 lb) A.C.S. grade calcium chloride dihydrate, 2050 g (1640 mL) USP glycerin, and 59 g (53 mL) 1,5-pentanedial (glutaraldehyde) (50% solution in water); diluted to 4L (1 gallon) with distilled or demineralized water? ____
   or (c) 577 g (1.27 lb) A.C.S. grade calcium chloride dihydrate, 2050 g (1640 mL) USP glycerin, and 563 g (53 mL) kathon CG/ICP; diluted to 4L (1 gallon) with distilled or demineralized water? ____

   Note: Stock solution may be made without using any biocide (formaldehyde, glutaraldehyde, or kathon), provided the storage time of the stock solution is not sufficient to promote fungi growth.

10. Working calcium chloride solution:
   (a) One measuring tin full (85±5 mL) of stock calcium chloride solution diluted to 4 L (1 gallon) with water? ____
   (b) Stored in 4 L (1 gallon) bottle on shelf 915±25 mm *(ASTM: 91±3 cm)* [36±1 in.] above work surface? ____
   Note: Solution may be stored in larger glass or plastic vat, provided the liquid level is maintained between 915 to 1170 mm (36 and 46 in.) *[ASTM: 36 and 45 in. (91 to 114 cm)]* above work surface.
   (c) Temperature of solution is 22±3°C (72±5°F)? ____
   (d) Solution is free of fungus? ____
   (e) AASHTO only: Solution discarded if more than 30 days old? ____
   ASTM only: Solution discarded if no more than 2 weeks old, and fresh solution not added to old solution (Sections 6.6 to 6.8)? ____

11. Straightedge or spatula (AASHTO only)? ____

12. Quartering or splitting cloth (AASHTO only)? ____

13. Oven, maintains 110±5°C (230±9°F)? ____

14. Work surface free of vibration and not exposed to direct sunlight? ____

15. 4.75 mm (No. 4) sieve (ASTM only)? ____

16. Flat pan (ASTM only), for mixing? ____

PROCEDURE

Sample Preparation

AASHTO only:

1. Sample pulverized and passed through 4.75-mm (No. 4) sieve? ____
2. All fines cleaned from +No. 4 particles and included with -No. 4 material? ____
3. Sample split or quartered to yield slightly more than four 85-mL (3-oz.) tins of -No. 4 material? ____
   Note: If necessary, material may be dampened before splitting or quartering to avoid segregation or loss of fines.

PLASTIC FINES IN GRADED AGGREGATES AND SOILS BY USE OF THE SAND EQUIVALENT TEST AASHTO T176 (continued)

Procedure (cont.)

Method 1 - Air Dry

AASHTO only:

1. Enough -No. 4 material split or quartered to fill the 85-mL (3-oz) tin slightly rounded above brim?.....____
2. While filling, bottom edge of tin tapped on hard surface to consolidate material? .....____
3. Tin struck off level full with spatula or straightedge?.....____
4. If using referee method (mechanical shaker), sample dried to constant mass at 110±5°C (230±9°F) and cooled to room temperature before testing? .....____

Method 2 - Pre-Wet (AASHTO)

5. Moisture condition checked by tightly squeezing small portion in palm of hand, forming a cast? .....____
6. Sample at proper water content (cast permits careful handling without breaking)?.....____
   (a) If too dry (cast crumbles easily), water added and remixed?.....____
   (b) If too wet (shows free water), sample drained and air dried, mixing frequently? .....____
7. If either (a) or (b) above occurred, sample placed in pan, covered with lid or damp cloth (not touching sample), and allowed to stand for at least 15 minutes?.....____
8. AASHTO: Sample placed on splitting cloth and mixed by alternately lifting each corner of cloth and pulling it over sample toward diagonally opposite corner, causing material to be rolled?.....____
9. AASHTO only: When material appears to be homogeneous, mixing finished with sample in a pile near center of cloth?.....____
10. Tin measure pushed through base of pile with free hand against pile opposite the measure? .....____
11. Material fills tin to overflowing? .....____
12. Material compacted into tin with palm of hand?.....____
13. Tin struck off level full with spatula or straightedge?.....____
14. AASHTO only: If using reference method (mechanical shaker), sample dried to constant mass at 110±5°C (230±9°F) and cooled to room temperature before testing?.....____

Procedure

1. 101.6±2.5 mm (4±0.1 in.) of working calcium chloride solution siphoned into plastic cylinder?.....____
2. Prepared sample poured from measuring tin into cylinder, using funnel to avoid spillage?.....____
3. Bottom of cylinder tapped sharply on heel of hand several times to release air bubbles? .....____
4. Wetted sample allowed to stand undisturbed for 10±1 minutes? .....____
5. Stopper placed in cylinder and material loosened from bottom by shaking?.....____
6. Mechanical Shaker Method (Reference Method):
   (a) Stoppered cylinder placed in mechanical shaker and timer set? .....____
   (b) Cylinder and contents shaken for 45±1 seconds?.....____

   Manual Shaker Method
   (a) Stoppered cylinder secured in hand shaker and stroke counter reset to zero? .....____
   (b) Fingertips pushed against right hand spring steel strap, and smooth oscillating motion maintained?.....____
   (c) Tip of pointer reverses direction within marker limits? .....____

   Hand Method
   (a) Cylinder held in horizontal position and shaken vigorously in horizontal linear motion from end to end? .....____
   (b) Cylinder shaken 90 cycles (one cycle is a complete back and forth motion) in approximately 30 seconds, using throw of 229±25 mm (9±1 in.) *[ASTM: 9±1 in. (23±3 cm)]* ?.....____

PLASTIC FINES IN GRADED AGGREGATES AND SOILS BY USE OF THE SAND EQUIVALENT TEST AASHTO T176 (continued)

Procedure (cont.)

7. Following shaking, cylinder set upright on work table and stopper removed? ____
8. Irrigator tube inserted in cylinder and material rinsed from cylinder walls as irrigator is lowered? ____
9. Irrigator forced through material to bottom of cylinder by gentle stabbing and twisting action while solution flows from tip? ____
10. Stabbing and twisting motion applied until cylinder filled to 381-mm (15-in.) mark? ____
11. Irrigator raised slowly without shutting off flow so liquid level is maintained at about 15 in.? ____
12. Final level adjusted to 15 in. before irrigator is removed from cylinder (AASHTO only: between top 2 graduations, but not above the 381-mm level)? ____
13. Cylinder and contents allowed to stand undisturbed for 20 minutes ± 15 seconds? ____
14. Timing started immediately after withdrawal of irrigator? ____

15. After sedimentation period, level at top of clay suspension (clay reading) recorded? ____
16. If no clear line of demarcation, sample allowed to stand undisturbed until clay reading can be obtained, and total sedimentation time recorded? ____
17. If sedimentation time exceeds 30 minutes, rerun test using 3 individual samples of same material, and clay reading requiring shortest sedimentation time recorded? ____
18. Weighted foot assembly gently lowered into cylinder, without hitting mouth of cylinder? ____
19. When foot comes to rest on sand, assembly tipped toward cylinder graduations until indicator touches cylinder? ____
20. 254 mm (10 in.) subtracted from level indicated by extreme top edge of indicator, and this value recorded as sand reading? ____
21. If clay/sand readings fall between 2.5-mm (0.1-in.) graduations, is level of higher graduation recorded? ____

Calculations

1. Sand equivalent calculated to 0.1 using following equation:? ____

$$\frac{\text{Sand Reading}}{\text{Clay Reading}} \times 100$$

2. If sand equivalent is not a whole number, reported as next higher whole number? ____
3. If desired to average sand equivalent values, and average is not a whole number, reported as next higher whole number? ____

BULK DENSITY ("UNIT WEIGHT") AND VOIDS IN AGGREGATE
AASHTO T19

This section may be omitted if Aggregate Properties proficiency testing is NOT required.

APPARATUS

1a. Unit Weight Measures	1	2	3	4
Capacity? – Record 2.8, 9.3, 14, 28, 70 or 100 L (1/10, 1/3, ½, 1, 2 ½, or 3 ½ ft^3)*				
Diameter? (Record)				
Height is 80 – 150% of diameter? (Record height)				
Top rim is smooth and watertight?				
Top rim is plane to 0.25 mm (0.01 in)?				
Interior wall of measure a smooth and continuous surface?				
Capacity less than 11 L (0.4 ft^3): Min. thickness of bottom = 5.0 mm (0.20 in)?				
Min. thick. of top 38 mm of wall = 2.5 mm (0.10 in)?				
Min. thick. of remainder of wall = 2.5 mm (0.10 in)?				
Capacity 11 to 42 L (0.4 to 1.5 ft^3): Min. thickness of bottom = 5.0 mm (0.20 in)?				
Min. thick. of top 38 mm of wall = 5.0 mm (0.20 in)?				
Min. thick. of remainder of wall = 3.0 mm (0.12 in)?				
Capacity >42 to 80 L (1.5 to 2.8 ft^3): Min. thickness of bottom = 10.0 mm (0.40 in)?				
Min. thick. of top 38 mm of wall = 6.4 mm (0.25 in)?				
Min. thick. of remainder of wall = 3.8 mm (0.15 in)?				

* The actual volume of measure shall be at least 95% of the nominal volume.
VOLUME = 3.142 d^2h /4 1 L = 0.001 m^3

Nominal Maximum Size mm	in.	Minimum Capacity of Measure, L	[m3}	(ft^3)
12.5 mm	1/2 in	2.8 L	0.0028	1/10
25.0 mm	1 in	9.3 L	0.0093	1/3
37.5 mm	1 ½ in	14 L	0.014	1/2
75 mm	3 in	28 L	0.028	1
112 mm (4 ½ in) *ASTM: 100mm (4 in)*		70 L	0.070	2 ½
150 mm (6 in) *ASTM: 125 mm (5 in)*		100 L	0.100	3 ½

1b. Measure used conforms to the table above? ____
OR Calibration factor determined?

2. Tamping rod: (a) Round, straight steel rod? ____
(b) 16 mm (5/8 in.) in diameter? ____
(c) Approximately 600 mm (24 in.) long? ____
(d) 16 mm (5/8 in.) hemispherical tip? ____

3. Shovel or scoop? ____

4. Calibration equipment: (a) Piece of plate glass (larger than the measure's diameter)? ____
(b) Chassis or water pump grease? ____

BULK DENSITY ("UNIT WEIGHT") AND VOIDS IN AGGREGATE
AASHTO T19 (continued)

APPARATUS (cont.)

5. Balance: (a) Graduated to at least 0.05 kg (0.1 lb) increments? ____
   (b) AASHTO: Readable to 0.1% of sample mass? ____
   ASTM: Accurate to 0.1% of test load? ____

PROCEDURE

1. Sample obtained by T248 *(ASTM C702)?* ____
2. Sample size approximately 125 to 200 percent of the quantity needed to fill the measure? ____
3. Sample dried to essentially constant mass at 110±5°C (230±9°F)? ____

Rodding procedure (up to 37.5-mm [1-1/2-in.] particles):

1. Measure filled 1/3 full and leveled with fingers? ____
2. Aggregate rodded with 25 evenly distributed tamping strokes? ____
3. Tamping rod does not forcibly strike the bottom of the measure? ____
4. Measure filled with two more similar layers? ____
5. Tamping strokes limited to layer being tamped? ____
6. Third layer filled to overflowing (before tamping)? ____
7. Surface leveled with the fingers or the straightedge (tamping rod)? ____
8. Average level surface obtained (aggregate projections above the rim balance the voids below the rim)? ____
9. Net mass determined to the nearest 0.05 kg (0.1 lb)? ____
10. Net mass of aggregate multiplied by calibration factor or divided by volume of the measure? ____
11. Bulk density reported to the nearest 10 kg/m^3 (1 lb/ft^3)? ____
12. Void content (if determined) reported to the nearest 1 percent? ____

Jigging procedure (37.5 to 150-mm [1-1/2 to 6-in.] particles):

1. Measure filled 1/3 full and leveled with fingers? ____
2. Layer compacted by raising alternate sides about 50 mm (2 in.) and dropping on floor 25 times on each side (a total of 50)? ____
3. Measure filled with two more similar layers? ____
4. Third layer filled to overflowing (before compaction)? ____
5. Surface leveled with the fingers or the straightedge (tamping rod)? ____
6. Average level surface obtained (aggregate projections above the rim balance the voids below the rim)? ____
7. Net mass determined to the nearest 0.05 kg (1 lb)? ____
8. Net mass of aggregate multiplied by calibration factor or divided by volume of the measure? ____
9. Bulk density reported to the nearest 10 kg/m^3 (1 lb/ft^3)? ____
10. Void content (if determined) reported to the nearest 1 percent? ____

Shoveling procedure (up to 150-mm [6-in.] particles):
Note: This method only used when specified. ----------

VDOT Note: This portion of AASHTO T19 is omitted since it is vary rarely used by VDOT for testing asphalt aggregates.

UNCOMPACTED VOID CONTENT OF FINE AGGREGATE
AASHTO T304
(a.k.a. Fine Aggregate Angularity)

This section may be omitted if Aggregate Properties proficiency testing is NOT required.

SAMPLE PREPARATION

1. Sample obtained by one of the following methods:
   - (a) C702 (splitting and quartering)?.....____
   - or (b) From sieve analysis samples used for C136?.....____
   - or (c) From aggregate extracted from a bituminous concrete specimen? .....____

2. Methods A and B:
   - (a) Sample washed over 150-µm (No. 100) or 75-µm (No. 200) sieve in accordance with C117?.....____
   - (b) Sample dried and sieved into separate size fractions in accordance with C136?.....____
   - (c) Necessary size fractions obtained from sieve analysis maintained in a dry condition in separate containers for each size? .....____

   Method C:
   - (a) A split of the as-received sample dried in accordance with the drying procedure of C136? .....____

Sample Preparation

Method A - Standard Graded Sample

1. Following quantities of aggregate that has been dried and sieved in accordance with C136 weighed out and combined:?.....____

Individual Size Fractions	Mass, g	OK?
2.36 to 1.18 mm (No. 8 to No.16)	44 ± 0.2	
1.18 mm to 600 µm (No. 16 to No. 30)	57± 0.2	
600 to 300 µm (No. 30 to No. 50)	72 ± 0.2	
300 to 150 µm (No. 50 to No. 100)	17 ± 0.2	
Total	190 ± 0.2	

Method B - Individual Size Fractions

1. Separate 190-g sample of aggregate, dried and sieved in accordance with C136, prepared for each of the following size fractions:? .....____

Individual Size Fractions	Mass, g	OK?
2.36 to 1.18 mm (No. 8 to No. 16)	190 ± 1	
1.18 mm to 600 µm (No. 16 to No. 30)	190 ± 1	
600 to 300 µm (No. 30 to No. 50)	190 ± 1	

2. Samples not mixed together and each size tested separately?.....____

Method C - As Received Grading

1. Sample (dried in accordance with C136) passed through 4.75-mm (No. 4) sieve?.....____
2. A 190±1-g sample of material passing the 4.75-mm sieve obtained? .....____

UNCOMPACTED VOID CONTENT OF FINE AGGREGATE
AASHTO T304 (continued)

SAMPLE PREPARATION (CONT.)

Specific Gravity of Fine Aggregate

1. If bulk dry specific gravity of aggregate from the source is unknown, specific gravity determined on material passing 4.75-mm (No. 4) sieve in accordance with C128? ____
2. This value used in subsequent calculations unless some size fractions differ by more than 0.05 from the specific gravity typical of the completed sample (in which case the specific gravity of the fraction(s) being tested must be determined)? ____
3. If specific gravity differences exceed 0.05:
   (a) Specific gravity of the individual 2.36-mm (No. 8) to 150-µm (No. 100) sizes determined for use with Method A or the individual size fractions for use with Method B? ____
   (b) Specific gravity determined by direct measurement or by calculation using specific gravity data on gradings with and without the size fraction of interest? ____

Procedure

1. Each test sample mixed with spatula until it appears to be homogeneous? ____
2. Jar and funnel section positioned in stand and cylindrical measure centered? ____
3. Finger used to block opening of funnel? ____
4. Test sample poured into funnel? ____
5. Material in funnel leveled with spatula? ____
6. Finger removed and sample allowed to fall freely into cylindrical measure? ____
7. After funnel empties, excess heaped aggregate struck off from cylindrical measure by single pass of spatula, with blade width vertical and using straight part of its edge in light contact with top of measure? ____
8. Care exercised to avoid vibration or any disturbance that could cause compaction of aggregate into cylindrical measure? ____
   Note: After strike-off, measure may be tapped lightly to compact sample to make it easier to transfer container to scale or balance without spilling any of the sample.
9. Adhering grains brushed from outside of container? ____
10. Mass of cylindrical measure and contents determined to nearest 0.1 g? ____
11. All aggregate particles retained for second test run? ____
12. Sample from retaining pan and cylindrical measure recombined and procedure repeated? ____
13. Mass of empty measure recorded? ____

Calculation

1. Uncompacted voids for each determination calculated as follows: ____

$$U = \frac{V - (F/G)}{V} \times 100$$

where:
V = volume of cylindrical measure, mL
F = mass of aggregate in measure
G = bulk dry specific gravity of aggregate
U = uncompacted voids in material, %

2. For Methods A and C, average uncompacted voids determined? ____
3. For Method B:
   (a) Average uncompacted voids for each size fraction determined? ____
   (b) The mean of the uncompacted voids including the results for all three sizes determined? ____

SPECIFIC GRAVITY AND ABSORPTION OF FINE AGGREGATE
AASHTO T84

This section may be omitted if Aggregate Properties proficiency testing is NOT required.

APPARATUS

1. Pycnometer:
   - (a) One of the following containers:
     - 1. Volumetric flask, capacity 500 mL (or more)? ____
     - or 2. Fruit jar fitted with pycnometer top? ____
     - or 3. Le Chatelier flask (as in T133/C188):
       - a. Space of at least 10 mm between highest graduation mark and lowest point of grinding for glass stopper? ____
       - b. Made of glass? ____
       - c. Neck graduated from 0 to 1 mL and from 18 to 24 mL? ____
       - d. Bottle and stopper have identical permanent identification markings? ____
       - e. Standard temperature marked on flask? ____
       - f. Unit of capacity marked above highest graduation line (mL)? ____
   - (b) Volume content can be reproduced to ±100 mm^3? ____
   - (c) Volume of container filled to mark at least 50% greater than space required to accommodate test sample? ____
2. Conical mold: (a) Height 75±3 mm? ____
   - (b) Inside diameter at top 40±3 mm? ____
   - (c) Inside diameter at bottom 90±3 mm? ____
   - (d) Metal, 0.8 mm minimum thickness? ____
3. Tamper: (a) Mass 340±15g? ____
   - (b) Flat circular tamping face? ____
   - (c) Diameter of tamping face 25±3 mm? ____
4. Buret (Optional-AASHTO), readable to 0.15 mL? ____
5. Balance: AASHTO: Class G2? ____
6. Oven, maintains 110±5°C (230±9°F)? ____

PROCEDURE

Sample Preparation

1. Sample obtained by T248? ____
2. Approximately 1000 g in size? ____
3. Dried to constant mass at 110±5°C (230±9°F)? ____
   Note: Oven drying not necessary if naturally moist condition is desired.
4. Covered with water or at least 6% moisture added? ____
5. Allowed to stand 15-19 hours or naturally moist? ____
6. Excess water decanted (if necessary) without loss of fines? ____
7. Sample spread on flat, nonabsorbent surface? ____
8. Uniformly dried by current of warm air? ____
9. Mold placed on flat, nonabsorbent surface and filled to overflowing? ____
10. Tamped 25 times with 5 mm drop? ____
    Note: See section 6.2.1 Note 2 1-4 for materials that do not readily slump.
11. Tamper allowed to fall freely under gravitational attraction? ____
12. Loose sand removed from around base and mold lifted vertically? ____
13. Sample fails to slump on first test? ____
14. If it does slump, is water added, sample covered and allowed to stand 30 minutes? ____
15. Drying continued and slump test repeated at frequent intervals until sample slumps slightly? ____

SPECIFIC GRAVITY AND ABSORPTION OF FINE AGGREGATE
AASHTO T84 (continued)

PROCEDURE (CONT.)

Procedure

1. Pycnometer partially filled with water and 500±10 g of saturated surface-dry sample added? ____
2. Pycnometer filled to 90% of total capacity and agitated to eliminate air bubbles? ____
   Note: Paper towel or isopropyl alcohol may be used to disperse foam on the water surface.
3. Temperature of contents adjusted to 23.0±1.7°C (73.4±3°F)? ____
4. Water level adjusted to calibrated capacity and mass of pycnometer and contents determined? ____
5. Sample removed and dried to constant mass at 110±5°C (230±9°F)? ____
   Note (AASHTO only): Second sample taken at the same time, within 0.2 g of the sample placed in the pycnometer, may be used to determine the oven-dry mass.
6. Sample cooled in air at room temperature for 1.0±0.5 hour and mass determined? ____
7. Empty pycnometer filled to its calibration capacity with water at 23.0±1.7°C (73.4±3°C) and mass determined (pycnometer may be previously calibrated)? ____
   Note: Quantity of water required to fill pycnometer may be determined using a buret.
8. All masses determined to nearest 0.1 g? ____
9. Lab says proper book formulas used in calculations? ____
10. If sample tested in a naturally moist condition, source of the sample and the procedures used to prevent drying prior to testing reported? ____

COMMENTS:

SPECIFIC GRAVITY AND ABSORPTION OF COARSE AGGREGATE
AASHTO T85

This section may be omitted if Aggregate Properties proficiency testing is NOT required.

APPARATUS

1. Sample container (One of the following):
   - (a) Wire basket of 3.35-mm (No. 6) mesh or finer? ____
   - or (b) Bucket of approximately equal breadth and height, capacity 4 to 7 L, for up to 37.5-mm (1 ½-in.) material (if needed)? ____
   - or (c) Larger container that prevents trapping air when submerged for plus 37.5-mm (1 ½-in.) material (if needed)? ____
2. Water tank:
   - (a) Capable of completely submerging the sample container? ____
   - (b) AASHTO only: Watertight tank equipped with overflow outlet? ____
3. Suspension apparatus and balance:
   - (a) Of suitable design and in good condition? ____
   - (b) Center of suspension apparatus properly located with respect to center of balance pan or other point of contact with balance? ____
   - (c) AASHTO only: Wire suspending the container is of smallest practical size? ____
4. Immersion water, temperature is 23.0±1.7°C (73.4±3°F)? ____
5. Large absorbent cloth? ____
6. Balance: AASHTO: Class G5? ____
   ASTM: Sensitive, readable, and accurate to 0.05% of sample weight or 0.5 g (greater)? ____
7. Sieves, 4.75 mm (No. 4) or other sizes as needed? ____
8. Oven, maintains 110±5°C (230±9°F)? ____

COMMENTS:

PROCEDURE

1. Sample obtained by T248? ____
2. Screened on 4.75-mm (No. 4 sieve) [or 2.36-mm (No. 8) sieve if sample contains substantial quantities of minus 4.75-mm material]? ____
3. Sample mass as follows: 1/2 in. or less - 2 kg; 3/4 in. - 3 kg; 1 in. - 4 kg; 1 1/2 in. - 5 kg? ____
4. Washed to clean surfaces of particles? ____
5. Dried to constant mass at 110±5°C (230±9°F) and cooled to room temperature for 1 to 3 hours (for up to 1 1/2-in. nominal maximum size, longer for larger sizes)? ____
   Note: Oven drying not necessary if naturally moist condition is desired.
6. Covered with water for 15 to 19 hours? ____
7. Rolled in cloth to remove visible films of water? ____
8. Larger particles wiped individually? ____
9. Evaporation avoided? ____
10. Sample mass determined? ____
    AASHTO: All masses determined to nearest 1 g or 0.1% of sample mass (whichever is greater)? ____
11. Sample immediately placed in sample container? ____
12. Mass determined in water at 23.0±1.7°C (73.4±3°F)? ____
13. Entrapped air removed before weighing by shaking container while immersed? ____
14. Dried to constant mass at 110±5°C (230±9°F) and cooled to room temperature for 1 to 3 hours (or until aggregate has cooled to comfortable handling temperature, approximately 50°C)? ____
15. Sample mass determined? ____
16. Lab says proper book formulas used in calculations? ____